Animal remains from Likoaeng, an open-air river site, and its place in the post-classic Wilton of Lesotho and eastern Free State, South Africa

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In several regions of southern Africa, Late Holocene post-classic Wilton assemblages (from *c.* 4000 BP) are associated with evidence of social and economic intensification. In this paper, we draw attention to Likoaeng, a newly excavated site in the Lesotho highlands, where fishing appears to have been the dominant subsistence activity. While analysis of the fish fauna recovered there continues, we concentrate here on reporting in detail the mammal, bird, reptile and mollusc assemblages from the first season's excavation at the site. Likoaeng is unique in that it has good bone preservation, not previously encountered at inland open-air, Later Stone Age sites. It is the largest faunal sample (fish excluded) to date recovered in Lesotho associated with the post-classic Wilton. To establish the place of Likoaeng within the post-classic Wilton, the remains are compared with those found in shelter sites in Lesotho and the eastern Free State that share comparable environmental conditions. Possible differences or similarities in respect of species composition, skeletal remains and bone preservation are discussed. Some of the taxa represented are not known historically from Lesotho. Remains also reflect both the open-air nature of the site as well as the riverine environment. Likoaeng provides a glimpse of life on a specialized camp site. It shows a major shift in the subsistence strategies represented by the upper and lower layers, from predominantly hunting in the latter to mainly fishing in the later period. The site provides evidence of specialization within the post-classic Wilton period. Compared with others in the region dating to the same period, Likoaeng was an important site, intensively occupied for very short periods at a time. The possibility that these occupation pulses were associated with aggregation activities is examined.

Introduction

The Lesotho highlands have been the subject of intensive archaeological research, particularly during the last decade. This has led to a greater understanding of Late Pleistocene and Holocene hunter-gatherer subsistence patterns in this region, as well as of the ecological conditions that shaped the environment in which these communities operated.[1,2] The sites identified and researched are all rock-shelters with stratified and dateable deposits (Fig. 1). Bone preservation in most of these deposits is limited to the Later Stone Age material of the terminal Pleistocene and the Holocene. Beyond this, little or no useful bone material has been preserved.

In several regions of southern Africa, Late Holocene post-classic Wilton assemblages (from *c.* 4000 BP) are associated with evidence of social and economic intensification, including enhanced exploitation of both freshwater and littoral/marine aquatic resources.[3,4] In this paper we discuss the fauna (fish excluded) from Likoaeng in detail and compare these finds with those from shelters in the region.

Open-air camp sites associated with Later Stone Age traditions in the interior of southern Africa seldom yield organic material. This is in contrast to coastal shell-midden sites, where conditions for organic preservation are generally good. There is also abundant evidence that these midden sites were regularly visited, resulting in a large build-up of deposits, thereby enhancing preservation. By contrast it seems that most inland open-air camp sites were occupied for short periods at a time only, resulting in the distribution of bones, bone fragments and other organic material as a thin surface scatter. This, in combination with generally acidic soils, selects against the preservation of organic materials. Good bone preservation at open-air sites becomes a regular occurrence only during the Iron Age, when the ash deposits of settled communities act as buffers against acidic soils. The bone preservation at Likoaeng is as good as that in the shelter sites.

To gain perspective on the non-fish remains from Likoaeng, it is necessary to compare the finds with those from other sites in the region. The sites used for comparison are Liphofung and Muela (both near 29°44′S, 28°27′E) at *c.* 1800 m above sea level,[5] Tloutle (29°28′S, 27°36′E) at 1870 m,[6,7] Bolahla (30°04′S, 28°24′E) at 1800 m,[5] Sehonghong (29°46′S, 28°47′E) at *c.* 1750 m,[8,9] Leqhetsoana (29°27′S, 27°36′E)[10] at 1650 m, and Rose Cottage Cave (29°13′S, 27°28′S)[2] at *c.* 1700 m. All are in Lesotho with the exception of Rose Cottage Cave, located just across the western border in the Free State. Only those units in these sites that are contemporaneous with the Likoaeng deposits, namely post-classic Wilton and ceramic post-classic Wilton, are discussed in this paper.

The domestic animals in the upper levels of Likoaeng reflect contact with Iron Age agropastoralist communities below the Drakensberg escarpment, as was probably also the case at Rose Cottage and the other sites where deposits date to the period before Iron Age settlement in the Free State and Lesotho.[5,11] Such contact was not necessarily widespread or common.[12–14]

Likoaeng: description, stratigraphy, dating and brief description of the non-faunal contents

Likoaeng was excavated by the second author and his students with help from members of the local community in 1995 and 1998.[15–17] This report considers material from the 1995 season. Likoaeng is more extensively excavated than any other site in the Lesotho highlands, dating to between 3500 and 1800 BP. It is situated on the west bank of the Senqu River (Orange River in South Africa) at 1730 m above sea level (29°44′S, 28°45′E) (Fig. 1). Initial inspection shows that it is a buried rock-shelter sealed by aeolian sediments.

Likoaeng's stratigraphic sequence is not very complicated. Briefly, it can be described as follows. Below an approximately 0.5–0.75-m thickness of culturally and faunal sterile sediments, Layer I is a loose, brown (7.5YR4/3), fine silt-like sediment, asso-

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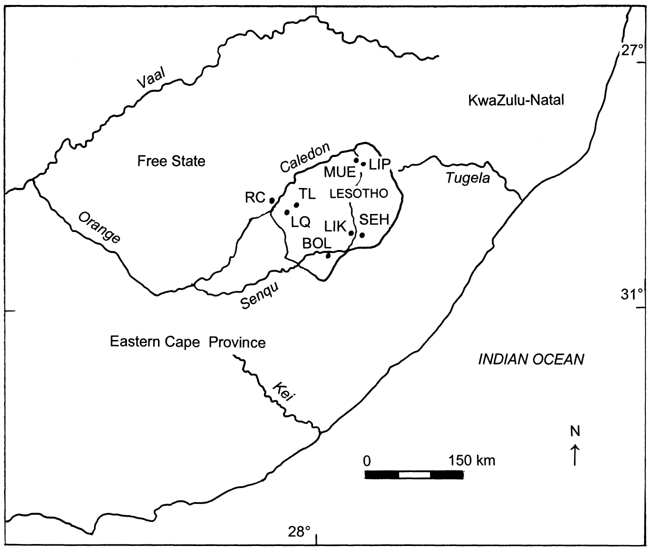

Fig. 1. Southern Africa with the positions of the sites indicated. MUE, Muela; LIP, Liphofung; TL, Tloutle; LQ, Leqhetsoana; LIK, Likoaeng; RC, Rose Cottage Cave; SHE, Sehonghong; BOL, Bolahla.

ciated with a small ceramic Wilton assemblage. The poor quality of faunal preservation in this layer and the absence of discrete features suggest it accumulated over a longer period and/or was covered more slowly than Layers III, V, and VII/VIII/IX (these three layers form a single unit). These horizons, which together form the bulk of the upper part of the cultural sequence, are separated from Layer I by Layer II, a fine-grained series of almost wholly sterile grey and yellowish-brown silts. Layers III, IV, and VII–IX are all yellowish-brown (10YR5/3) to dull brown (7.5YR5/3) silty horizons rich in bone, stone artefacts and charcoal. Separately identifiable features within them include several shallow hearths and pits. Layers IV and VI, which separate them, are culturally more sterile in content and firmer, fine-grained brown (7.5YR4/4) silts. Layers III, V, and VII/IX are interpreted as occupation horizons, and cultural material in layers IV and VI is probably derived from them.

Sampled over a much smaller area (between 3.6 and 6 m^2 compared with 22–32 m^2 of the overlying deposits), the lower layers span a total thickness of some 1.5 m. They consist of a series of fine-grained, virtually sterile orange-brown or yellow-brown sands and darker, grey/dull brown, ashy sandy silts (Layers XII–XVI) rich in artefacts and bone, some of which are themselves stratigraphically subdivisible. Below Layer XVII a deeper sondage shows that the deposit continues for at least one metre, consisting of coarser-grained sand with very rare stone flakes and poorly preserved bone fragments. Bedrock was not reached. Below Layer XI the lower sediments increasingly slope down towards the river and are associated with a marked increase in the quantity and size of sandstone inclusions. We suggest that they represent part of a talus of a buried rock-shelter, while the upper horizons at Likoaeng reflect continued use of the site as a totally open-air location after the shelter's interior became inaccessible. Test excavations carried out in 1998 support this interpretation.[16] The thickness of the layers varies between levels and within a layer. Table 1 gives the volume of deposit per layer and the number of specimens present per bucket volume.

The finds other than the identified fauna from Likoaeng can be summarized as follows:

Layer I: pottery is restricted to this part of the sequence, and this layer also has very few flaked stone tools, retouched artefacts, worked bone or grindstones.

Layers III–IX: the flaked stone tool assemblage from these layers is much larger. Scrapers are the most common formally retouched artefact class, with adzes, backed microliths and bifacially worked points also present. Pressure-flaked backed points and bladelets are restricted to these layers. The worked bone assemblage includes points, point/linkshaft fragments, fragments of a polished (human?) cranium and polished tortoise carapace, and ostrich eggshell beads (almost all from Layer V). Upper and lower grindstones occur, and Layer VII produced a reamer and bored stone.

Layers X–XVII: adzes are more frequent in this part of the sequence than above, although scrapers remain the most common formally retouched artefacts. Backed microliths are present, but none shows evidence of pressure-flaking. Grindstones are more common and the worked bone assemblage is also more plentiful. Dominated by points and point/linkshaft fragments, it also includes a single fish hook and a cut and snapped springhare metatarsal. Rare ostrich eggshell and bone beads also occur. Numbers of both stone and bone artefacts are reduced in Layers XIV–XVII.

The site dates to the Late Holocene, with most of the cultural material associated with the post-classic Wilton. Ceramics were present only in Layer I and include a single decorated Early Iron Age sherd, along with undecorated Later Stone Age pottery. Similar post-classic Wilton assemblages have been found in the deposits of Sehonghong, a site close to Likoaeng. The Likoaeng dates are based on charcoal samples and are as follows:

Pta-7877	1310 ± 80;	AD 670 (769) 874	Layer I
Pta-7865	1830 ± 15;	AD 235 (243) 250	Layer III
Pta-7097	1850 ± 15;	AD 221 (233) 252	Layer III
Pta-7092	1850 ± 40;	AD 159 (233) 252	Layer V
Pta-7870*	2100 ± 80;	173 BC (46 BC) AD 90	Layer VII
Pta-7098	2060 ± 45;	52 BC (6 BC) AD 43	Layer VII
Pta-7101	2390 ± 60;	413 (396) 379 BC	Layer XI
Pta-7093	2650 ± 60;	816 (799) 781 BC	Layer XIII
GrA-13535	3110 ± 50;	1400 (1362),1314) 1266 BC	Layer XVII

*This date is out of sequence and almost certainly derived from a charcoal sample contaminated as the result of localized disturbance by the common molerat (*Cryptomys hottentotus*). The material could have come either from layers below or above.

All determinations were performed on charcoal, pretreated with acid and alkali. Ages are expressed using the Libby half-life, corrected for isotopic fractionation. Calibrated ages are given using the Pretoria program for the southern hemisphere,[18] showing the 1 sigma range, with the most probable date(s) in brackets.

Methods

The fauna of Likoaeng and that of the other sites mentioned were analysed according to internationally accepted procedures. Specimens that could not be identified were counted and listed, and examined for human and animal-incurred damage as well as for other taphonomic indicators such as traces of burning and weathering.

Bovid size classes were determined following the suggestions by Brain[19] and relative age classes according to Plug.[20]

The material in all the sites is comminuted. Measurements were taken on those few specimens that are sufficiently preserved. Specimens were measured using the methods outlined by Von den Driesch[21] and a vernier calliper accurate to 0.1 mm. Measurements of archaeological bone from a variety of sites are housed on file at the Transvaal Museum, Pretoria, and

Table 1. Total bone sample and unidentified fish remains expressed in average per bucket excavated at Likoaeng in 1995. Layer X and lower were excavated as a 1.5 m^2 test pit only.

Layer	Volume in buckets	Formal tools per bucket	Total mass of bone in g per bucket	No. of all bones per layer	Unidentified fish per bucket	No. of all bones per bucket	Rank
I	172.75	0.08	0.96	825	0.04	5	14
II	≥200	–	0.11	752	≤2	4	15
III	256.51	0.11	15.08	176 767	630	689	6
IV	21.75	0.05	1.49	877	32	40	12
V	122.53	0.38	22.61	89 210	668	728	5
VI	165.42	0.10	3.70	13 014	76	79	10
VII, VIII, IX	176.42	0.43	56.02	252 066	1 259	1 429	3
X	16.50	0.06	0.56	184	9	11	13
XI	26.50	0.23	8.21	2 831	46	107	8
XII	8.00	0.75	27.11	1 827	189	229	7
XIII	48.25	1.20	90.00	69 434	1 143	1 439	2
XIV	4.00	3.00	236.03	8 832	721	2 208	1
XV	9.00	0.22	17.53	775	4	86	9
XVI	12.00	0.08	10.78	742	1	62	11
XVII	3.00	–	157.30	2 780	417	927	4

form part of an extended research project. Details of measured bone from Likoaeng are on file with the first author. The measured sample is small, so that means and standard deviations were not calculated.

Faunal samples

The samples from the shelters are dominated by bovid remains. However, the bulk of the Likoaeng sample of the first 10 layers consists largely of fish remains; this changes in the lower layers, where mammals and bovids in particular become prominent. The fish remains are in the process of being analysed by the first and third authors as a separate research project and are not described here. The entire sample, however, fish included, has already been sorted, counted and weighed. Figure 2 provides perspective on the ratio of fish to other animal remains at Likoaeng and represents the entire sample of identified and non-identified specimens. The upper Later Stone Age levels at Rose Cottage also contain numerous fish remains, but these have not yet been analysed.[22]

Species represented

The species identified from the Likoaeng samples include vertebrates as well as invertebrates (Table 2). Table 3 lists the larger mammals (humans excluded) identified from Likoaeng and the other sites dating to the same period. Micromammals and invertebrates are not included in the table as these were not submitted for analysis in all instances. Details of species present at sites other than Likoaeng are discussed in various papers and reports.[5,6,8,11]

Remains of two human individuals, a juvenile and an adult, are present at Likoaeng, but there is no evidence of graves. Domestic animals are present in the upper levels of all the sites. The sheep fragments from Layers IV and VI at Likoaeng are from one individual and seem to belong to one of the animals from the first two or three levels.

Most identified taxa have modern or historical distribution records for Lesotho. Taxa (domesticates excluded) that have no known modern distribution record for that country are the vervet monkey, warthog, steenbok, blue duiker and ostrich.[8,23–26]

There is a clear increase in mammal remains in the lower levels at Likoaeng (Fig. 2). Small bovids (Bov I) increase from 39% in Layers I–IX to 46% of the sample in Layers X–XVII. Medium bovids (Bov II) decrease from 57% in the first nine levels to 36% in the lower levels. Large bovids (Bov III) fluctuate between 3.5% and 4% throughout, but eland remains (Bov IV) increase by a factor of seven from 2% in the first nine levels to 14% in Layers XI–XVII.

Ostrich eggshell beads and worked bone artefacts occur in the deposits of all sites but in most cases, including Likoaeng, these have not been submitted for analysis.

Bovid skeletal elements represented and bone densities

The sample of skeletal elements present at Likoaeng is comparable with that of Sehonghong, Tloutle and Rose Cottage Cave[6,8,11] and most represent mammals. These are listed and calculations to determine under- or over-representation were performed according to O'Connor and Reitz and Wing[27,28] and are available on request. There are many similarities but also some differences between the samples of the upper levels and the lower layers at Likoaeng, largely due to the greater presence of mammal remains in the lower layers. In virtually all the sites, sesamoids and third phalanges are under-represented, and proximal and distal metapodials over-represented. The other skeletal elements vary in representation, and no clear pattern could be established. These discrepancies and variations must be considered in terms of sample size, butchering practices, bone densities[29] and natural attrition processes.

Ageing and sexing

Adult animals dominate in all the samples, including those from Likoaeng, where only seven young and five mature

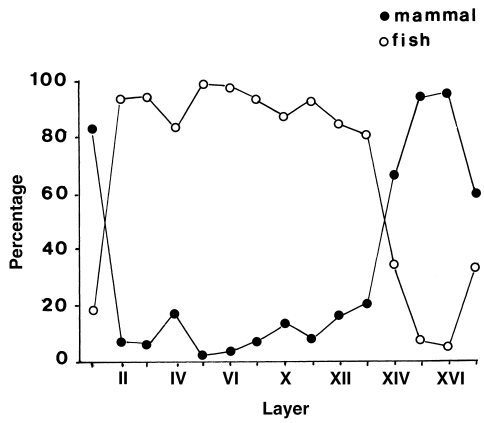

Fig. 2. Total faunal sample of the Likoaeng deposits, illustrating the relation between the fish and non-fish samples.

Table 2. Likoaeng: Species present as NISP (number of identified specimens) counts.

Layer and species	I	II	III	IV	V	VI	VII VIII IX	XI	XII	XIII	XIV	XV	XVI	XVII
cf. *Homo sapiens sapiens,* human	2	0	0	0	1	9	3	1	0	0	0	0	0	0
Papio hamadryas, Chacma baboon	1	2	0	0	0	0	4	2	0	8	2	0	0	0
Chlorocebus aethiops, vervet monkey	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Canis mesomelas, jackal	0	0	0	0	2	0	4	3	3	0	0	0	0	0
Canis sp.	0	0	0	0	0	0	0	1	0	2	0	0	0	0
cf. *Mellivora capensis,* honey badger	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Aonyx capensis, otter	0	0	0	0	0	0	0	1	1	7	0	0	0	0
Atilax paludinosus, water mongoose	0	0	0	0	0	1	8	0	0	0	0	0	0	0
Mongoose	0	0	4	0	1	1	3	3	0	1	0	0	0	0
Panthera pardus, leopard	0	0	0	0	0	0	1	0	0	0	0	0	0	0
cf. *Caracal caracal,* caracal	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Carnivore indeterminate	0	0	0	0	0	4	12	3	0	1	0	0	0	0
Procavia capensis, hyrax	0	0	0	0	1	0	2	1	0	6	2	1	4	0
Phacochoerus aethiopicus, warthog	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Suid	0	0	0	0	0	0	1	0	0	0	0	1	0	0
cf. *Ovis aries* sheep	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Ovis/Capra sheep/goat	4	0	2	0	0	0	0	0	0	0	0	0	0	0
Bos taurus, cattle	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Sylvicapra grimmia, duiker	1	0	0	0	1	0	3	0	0	0	2	1	0	0
Oreotragus oreotragus, klipspringer	0	0	0	0	0	0	20	4	0	9	0	0	0	0
Raphicerus campestris, steenbok	0	0	2	0	0	0	7	3	0	12	10	2	0	0
Oreotragus/Raphicerus	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Pelea capreolus, grey rhebuck	0	0	12	0	4	2	13	8	0	38	8	3	0	0
Taurotragus oryx, eland	0	0	0	0	1	0	0	4	1	47	11	2	18	7
Redunca fulvorufula, reedbuck	0	0	1	0	0	0	10	0	0	1	0	0	0	0
Pelea/Redunca	1	0	2	1	3	1	11	0	0	17	10	0	1	1
Bov I	1	0	35	0	11	10	66	70	2	87	36	7	0	4
Bov I/II	0	0	1	0	1	1	0	0	0	0	0	0	0	0
Bov II	8	1	36	1	29	20	82	20	2	59	34	6	1	13
Bov III	5	0	0	0	2	2	5	0	1	10	3	0	0	2
Bov III/IV	0	0	0	0	0	0	2	0	0	5	0	0	1	0
Bov IV	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Pedetes capensis, springhare	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Hystrix africaeaustralis, porcupine	0	0	0	0	0	0	1	0	0	3	0	0	0	0
cf. *Cryptomys hottentotus,* mole rat	2	0	0	0	0	0	0	0	0	0	3	0	0	0
Otomys irroratus, vlei rat	0	0	0	0	0	0	3	0	2	12	1	0	0	0
Otomys sp.	1	0	5	3	2	1	10	1	0	0	0	0	0	0
Praomys natalensis, mouse	0	0	0	0	0	0	5	0	0	0	0	0	0	0
Rodent small	0	0	4	0	0	1	5	7	0	7	0	2	0	0
Lepus saxatilis, hare	0	0	22	0	0	1	14	8	0	18	2	1	0	0
Lagomorph	0	0	13	0	2	1	4	3	0	5	1	0	1	2
Struthio camelus, ostrich	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Bird medium	0	0	0	0	0	1	13	0	0	4	0	0	0	0
Numida meleagris, guinea fowl	0	0	0	0	0	0	0	0	0	1	0	0	0	0
cf. *Numida meleagris*	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Raptor	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Tortoise	0	0	2	0	0	1	2	0	0	3	0	0	0	0
Lizard/gecko	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Snake	0	0	1	0	0	1	1	0	0	0	0	0	0	0
Varanus sp., monitor lizard	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Lizard	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Xenopus laevis	0	0	0	0	0	0	2	1	0	0	0	0	0	0
Achatina sp., giant land snail	0	0	25	0	186	3	22	0	0	4	2	0	0	0
Terrestrial snail	0	1	14	0	172	21	6	3	0	20	15	6	0	1
Bulinidae, freshwater snail	0	0	0	0	0	0	0	0	0	4	1	0	0	0
Unio caffer, freshwater mussel	0	0	7	0	9	3	33	4	0	0	3	1	0	0
Unionidae, freshwater mussel	0	0	11	0	15	13	6	8	0	14	0	0	1	0
Insect pupa mud/dung case	0	0	0	0	0	0	1	0	0	1	0	0	0	0

and aged individuals were present (a juvenile human, water mongoose, hyrax, baboon, warthog and two bovids, and a mature/aged human and four bovids).

Very few specimens could be sexed owing to the fragmented nature of the samples. At Likoaeng only eight bovid males were identified. These are represented by a few horncore and pelvis fragments. In the other sites, similar patterns of ageing and sexing were observed.[6,5,11]

Taphonomy

Bone preservation in the Likoaeng deposits is good and compares favourably with that of the other sites. Most of the Likoaeng specimens can be classified between weathering stages 0 and 1.[30] Wear stages 1/2, 2/3 are often seen in the bones from shelter deposits and Iron Age sites, usually indicating periods of prolonged exposure and/or adverse soil conditions. Likoaeng is therefore unique not only for Lesotho but also for the central highlands of South Africa. Excessive weathering is rare, and only two specimens, a proximal metatarsal of a medium bovid (Bov II) and a pelvis acetabulum fragment of a large bovid (Bov III) from Layer IX, are weathered beyond the condition of the other specimens in this layer. Their surfaces are eroded and cracked, corresponding to Behrensmeyer's stage 3.[30]

Butchering damage is visible on a few Likoaeng specimens. This consists of three shallow, parallel cut marks above the distal articulation perpendicular to the length of the shaft on a 1st phalanx of a grey rhebuck (Layer V); and shallow cut marks on

Table 3. Comparison between larger mammal species of the post-classic to ceramic Wilton from sites in Lesotho and Rose Cottage across the border near the Caledon River, NISP per species.

Species	LIK	LIP	MUE	TL	BOL	SEH	LQ	RC
Insectivore	0	0	4	1	1	2	0	0
Papio hamadryas, Chacma baboon	19	5	5	4	4	34	0	17
Chlorocebus aethiops, vervet monkey	1	0	4	0	0	0	0	0
Vulpes chama, Cape fox	0	0	0	0	0	0	0	2
Canis mesomelas, jackal	11	1	2	3	0	1	0	12
Canis sp.	3	0	0	1	0	1	0	5
Lycaon pictus, wild dog	0	0	0	0	0	1	0	0
cf, *Mellivora capensis,* honey badger	2	0	0	0	0	0	0	0
Aonyx capensis. otter	9	0	0	0	0	0	0	0
Cynictis penicillata, yellow mongoose	0	0	0	0	0	0	0	1
Atilax paludinosus, water mongoose	9	0	0	0	0	6	0	2
Mongoose	13	1	3	5	2	1	3	18
cf, *Proteles cristatus,* aardwolf	0	0	0	0	0	4	0	0
Hyaena brunnea, brown hyaena	0	0	0	0	0	0	0	2
Hyaena	0	0	0	0	0	0	0	1
Panthera pardus, leopard	1	0	0	1	1	0	0	10
Felis lybica, wildcat	0	3	0	1	0	1	0	8
Felis sp.	0	0	0	0	0	6	0	0
Caracal caracal, caracal	2	0	2	0	0	2	0	6
Carnivore gen. et sp. indet.	19	3	0	2	0	3	0	10
Equus asinus, donkey	0	0	0	0	0	1	0	0
Equus burchellii, zebra	0	0	0	9	0	0	0	7
Procavia capensis, hyrax	17	27	19	53	22	278	15	282
Sus scrofa, domestic pig	0	6	0	0	0	3	0	0
Phacochoerus aethiopicus, warthog	2	0	1	4	0	4	5	50
Potamochoerus porcus, bushpig	0	0	0	0	0	0	1	0
Suid	2	0	0	2	0	3	0	8
Capra hircus, goat	0	0	0	1	1	0	3	28
Ovis aries, sheep	2	3	1	0	2	17	0	16
Ovis/Capra, sheep/goat	2	10	8	18	14	37	6	19
Bos taurus, cattle	2	4	2	42	2	33	10	21
Connochaetes taurinus, blue wildebeest	0	5	1	2	0	1	7	68
Alcelaphus buselaphus, hartebeest	0	0	1	1	0	3	0	19
Connochaetes/Alcelaphus	0	0	0	20	0	1	2	39
Damaliscus pygargus, blesbok	0	0	3	2	0	0	1	71
Alcelaphine sp. indet.	0	0	0	0	0	0	0	9
Philantomba monticola, blue duiker	0	0	1	0	0	0	0	0
Sylvicapra grimmia, duiker	7	0	4	2	2	9	2	7
Antidorcas marsupialis, springbok	0	0	2	4	0	0	1	316
Oreotragus oreotragus, klipspringer	32	37	24	14	0	14	5	1
Ourebia ourebi, oribi	0	3	7	0	0	4	0	0
Raphicerus campestris, steenbok	36	1	31	8	0	42	0	15
Oreotragus/Raphicerus	2	0	0	3	0	0	0	0
Aepyceros melampus, impala	0	0	5	0	0	0	0	0
Antidorcas/Aepyceros	0	0	6	0	0	0	0	0
Pelea capreolus, grey rhebuck	87	11	3	3	0	38	0	31
Hippotragus equinus, roan	0	0	0	0	0	2	0	0
Hippotragus sp., sable/roan	0	0	0	0	0	6	0	0
Taurotragus oryx, eland	91	38	4	45	1	22	3	32
Redunca arundinum, common reedbuck	0	0	0	2	0	0	0	0
Redunca fulvorufula, mountain reedbuck	1	25	27	2	1	8	0	22
Redunca spp.	0	0	0	2	0	0	0	0
Pelea/Redunca	48	0	8	0	0	0	0	2
Bov I	329	57	55	40	70	104	13	82
Bov I/II	3	0	0	0	0	0	0	0
Bov II	311	75	63	76	64	100	26	505
Bov III	30	9	2	72	3	33	18	13
Bov III/IV	8	0	0	0	0	0	0	0
Bov IV	2	0	0	0	0	0	0	0
Xerus inauris, ground squirrel	0	1	0	1	0	0	0	14
Pedetes capensis, springhare	2	0	0	0	0	1	1	13
Hystrix africaeaustralis, porcupine	4	2	2	6	1	2	2	11
Lepus saxatilis, hare	65	0	0	0	0	14	0	25
Lepus sp.	4	0	1	0	0	11	0	39
Pronolagus rupestris, Smith's red hare	0	0	3	0	0	0	0	0
Lagomorph	28	3	7	2	0	12	9	62
Total NISP	1206	330	311	454	191	865	133	1921
No. of species present	21	18	25	25	13	37	15	29

LIK: Likoaeng; LIP: Liphofung; MUE: Muela; TL: Tloutle; BOL: Bolahla; SEH: Sehonghong; LQ: Leqhetsoana; RC: Rose Cottage.

the pelvis ischium of a Bov I (Layer VII). There are very few specimens where rodent or carnivore gnawing was observed. A carnivore puncture mark occurs on the distal tibia of a water mongoose, chew marks on a tibia crista and a metapodial shaft of a Bov II, and scratch or score marks caused by carnivore teeth feature on the pelvis ilium blade of a Bov I, all from Layer VII. A chewed Bov III/IV tibia unfused epiphysis comes from Layer XIII. The carnivore damage on the specimens was caused by small to medium-sized animals, not larger than jackals.

Burnt bones are common in all the shelter sites and at Likoaeng. In appearance they range from light discolouration due to scorching to black, and the white and grey-white of calcined bone. The last indicates exposure to high temperature, probably in excess of 400°C. In some units over 60% of all fragments are burnt; as several hearth features were identified during the excavations, in most sites, the high incidence of burnt bone is to be expected. Very few burnt *Achatina* shell fragments occur at Likoaeng.

Modified bone

Bone tools, other modified bone and shell objects from the various sites have not been analysed, but the faunal samples from Likoaeng inadvertently contain over 70 modified bone fragments. All but four of these are point and/or linkshaft fragments. Most have an unfinished look. They are angular with the tool marks clearly visible and little or no polish. Descriptions are available on request. Similar roughly made tools are also present at Pitsaneng, a rock shelter within walking distance of both Sehonghong and Likoaeng (J. Hobart, pers. comm.). It may be argued that these objects were tools in their own right, and were regarded as complete by their makers and users. All the tools at both sites still need to be studied, which may provide a better insight into the tool manufacturing and tool use of the people of Likoaeng and Sehonghong.

Discussion and conclusions

Likoaeng: accumulation and integrity of the deposits

At Likoaeng, the volume of deposit does not necessarily equate with the abundance of faunal material (Table 1) and the thickest layers are not always the richest. The mechanisms of deposition at the site are not fully understood, but the condition and distribution of the bones, mammalian as well as fish, indicate that the deposits built up rapidly, leaving little time for weathering and displacement of specimens. There is no evidence of surface deflation. Wind-blown dust and sand add to the deposit at present, and most likely did so during the later Holocene. A dust storm hit the site during excavation. It lasted half a day and deposited approximately 13 mm of dust on the excavation.

There is a strong possibility that Likoaeng was subjected to flooding in the past as it is close to the Senqu River. It is not yet possible to ascertain the frequency of such inundations and what their effects would have been on the deposits and their contents. Flash floods would have disturbed the deposits markedly, but there is no evidence of lateral displacement of the faunal material. Numerous fish and some of the other more fragile remains show splitting and warping, however, usually not seen in the faunas from the shelter sites. This is suggestive of alternating wet and dry conditions in the Likoaeng deposits. Whether this is the result of rain inundation or periodic slow flooding of the river cannot yet be ascertained with any certainty. However, the small freshwater gastropods indicate that there was at least some periodic inundation.

The distribution of the human remains below Layer III at Likoaeng is difficult to explain. During excavation, no traces of graves or major disturbances were found. Only a few elements of two individuals are represented and their inclusion in the deposits should be investigated. The distribution of sheep bones from one individual over several layers suggests some localized vertical disturbance in the upper levels of the deposit.

There is no evidence that carnivores caused any major disturbances of the various deposits, but there is proof of some localized disturbance by rodents. The date Pta-7870 from Layer V is from a disturbed context, associated with rodent burrowing, but we do not know whether its charcoal was upturned from Layers VII–IX.

Numerous small terrestrial snails have been identified from Likoaeng. Although some burrow to aestivate, they do not dig deep and it is unlikely that they caused any significant disturbance.

The giant African land snail (*Achatina*) tends to bury itself in shelters and soft open-air deposits,[31] to aestivate. *Achatina* shell fragments are particularly common in Layer V at Likoaeng. In shelter sites where occupation horizons are often thin, these snails are more likely to cause some disturbance. In most of the shelter deposits, however, such disturbances appear minimal, at least as far as the animal remains are concerned.[32] The scant evidence of burning on the *Achatina* remains from Likoaeng also indicates that they were introduced after each layer was deposited. To what extent these intrusions could have disturbed the deposits is difficult to establish. The shells are very fragmented and do not look fresh. They appear to have been subjected to the pressure of overlying deposits and compaction for a long time. Perhaps they were incorporated into the various levels soon after these deposits were formed and most of the shells are therefore not much younger than the layers in which they were found. Any possible disturbance they could have caused would have been restricted to within rather than between layers.

The purpose of the successive occupations at Likoaeng was aimed at intensive food procurement and processing, particularly of fish. These concentrated periods of activity probably contributed to the rapid accumulation of deposits. As a result, the deposits and their bone contents were quickly sealed and protected by subsequent layers.

Non-contributors in the deposits

Determining which animals are associated with an archaeological deposit and which are not can be a problem. On permanent or semi-permanent sites, non-contributors are usually limited and generally restricted to small animals such as snails, some burrowing mammals such as springhares, aardvark and small rodents, and, rarely, a larger animal that died on the site after it was abandoned. In most cave and shelter sites the problem is more complex. There can be potentially more animals present in the deposits not associated with the archaeological remains. Likoaeng is principally an open-air site, but it was not occupied continuously. There is therefore a strong possibility that some animals became incorporated into the deposits without human action. At Likoaeng the following could be self-introduced: some or all of the smaller rodents, lizards and snakes, and all of the frogs, small land snails, freshwater snails, and insect larval/pupae cases. In most of the shelter sites the frogs and freshwater snails could not have been self-introduced and small predators and raptors are the most likely agents of their introduction.

The large number of small terrestrial snails is unique to Likoaeng; they are absent or scarce at the shelter and cave sites.[6,7] Owing to their small size and relatively restricted browsing territories, they tend not to traverse the large barren expanses of cave or rock-shelter floors, whereas the much larger giant land snail has no such restrictions.[33] At Likoaeng the presence of these small shells can be explained only by natural or self-introduction.

Burnt fragments are not uncommon in most of the shelter sites where *Achatina* shell is found, and often there also are a few shell beads and/or ornaments, indicating that at least some of the shells were collected by people for food and other uses, and therefore associated with the archaeological horizons. Burnt shell is rare at Likoaeng and worked shell fragments of any kind are absent, which suggests that these molluscs were not utilized by people.

Determining the agents of accumulation of larger mammals is more of a problem. Where only one or a few bones of a single individual of a species are identified, it is rarely possible to determine whether it is a natural inclusion or brought onto the site by agents such as humans or carnivores. When the skeleton is more or less intact, it is likely that it died on the site with little or no disturbance of the remains. At Likoaeng the otter, badger and water mongoose, for example, could arguably fall in either category, whereas the presence of such animals in shelter sites almost certainly involved human or predator activities. The remains consist of isolated bone elements only, arguing against a natural death, but the absence of butchering and carnivore marks, although not excluding human involvement, does not prove it.

Hyraxes also pose problems in shelter sites. They are both food items for people and predators,[11] but also live in many shelters and die there from natural causes. Likoaeng is not a suitable living area for hyraxes nor for carnivores. They must therefore have been introduced by people.

Baboon remains are present at all the sites, but are particularly common at Sehonghong, where they constitute 3.9% of the identified sample. On the other sites these percentages fluctuate from 0.9% at Rose Cottage Cave and Tloutle, to 2.1% at Bolahla. In the case of Rose Cottage Cave, leopards may have been responsible for the accumulation of some baboon and hyrax material;[11] this could also have been the case in the other rock-shelter sites, where baboon remains are common. As baboons use shelters at night, however, the possibility that some individuals died a natural death in some of the shelters cannot be ruled out.

We know that baboons must have had some meaning for the post-classic Wilton people. This is attested by a drilled canine of a male baboon from Rose Cottage Cave[11] and by black paintings at Sehonghong.[34] The baboons at Likoaeng (1.7% of the identified sample) must have been introduced into the deposits as result of human action. The area on and immediately around the site is not suitable for large trees, nor does it contain features suitable for baboon roosts or for leopards to take prey to.

Carnivore damage is present on some bone fragments from most of the sites. The chew marks on the few carnivore-damaged bones at Likoaeng were probably caused by jackals. In all the sites carnivore damage is limited and negligible compared to the total samples; it is unlikely that the carnivores were primary accumulators at any of the sites. Rodent gnaw marks are present on a limited number of fragments. Both carnivores and rodents may have taken advantage of the refuse accumulated through human activities.

Large freshwater mussels in shelter sites are all introduced, mostly by people. At Likoaeng they could have been introduced also during episodes of flooding. If collected they would have been eaten, but it is uncertain where they were collected. The river bed immediately in front of Likoaeng is filled with a large fan of gravel, rocks and boulders, not a suitable habitat for these freshwater mussels; they prefer sandy or muddy river bottoms.[35,36] As these are present both up- and downstream from Likoaeng, they would have been collected in those localities in relatively slow-flowing or standing water.

Sample sizes

Table 3 clearly shows that Likoaeng is an important site. Notwithstanding the specialized nature of the place as a fishing camp, its non-fish sample is the largest of all and is exceeded only by the material from Rose Cottage Cave. Although a large sample of fish specimens is present in some of the upper layers at Rose Cottage Cave, these have not yet been analysed and can therefore not be used for comparison.[37]

The diversity of species in these various samples does not correlate well with sample size. The greatest diversity is at Rose Cottage, with 29 taxa represented. At Likoaeng 21 different taxa are present; these are exceeded, however, by those from some of the much smaller samples such as Sehonghong, Muela and Tloutle. The lowest species diversities are at Bolahla and Leqhetsoana with 13 and 15, respectively, but these samples are small and the relative paucity could be an effect of sample size. Elevation above sea level does not explain these differences. It is possible that shelter size, depth of the overhang or the position of the opening in relation to the dominant wind directions could have influenced the occupation intensity of the different shelters. The faunal diversity in the vicinity or within the radius of a one or two day hunting trip could also have been a factor. Little is known about the diversity of the fauna in Lesotho at the time. Although some indications are provided by the individual faunal samples and the samples in combination, little can be inferred about the micro-environmental settings of the individual sites as they apply to the larger mammals.

Representation of animals

The domestic animals in the upper levels of Likoaeng reflect contact with Iron Age agropastoralist communities below the Drakensberg escarpment. This was probably also the case at Rose Cottage and the other sites where deposits date to the period before Iron Age settlement in the Free State and Lesotho.[5,11] Such contact was not necessarily widespread or common.[12–14]

The region of Likoaeng falls outside the known distribution range of the vervet monkey.[25] Remains were found in Layer I and also in the Muela deposits. However, these monkeys have been recorded from just within and outside the southern and eastern borders of Lesotho. Remains of these animals have been found also in earlier Later Stone Age deposits at Rose Cottage.[11] They are opportunistic feeders and will move along river corridors to areas outside their normal range provided suitable vegetation is available.

It appears that warthogs did not occur in Lesotho during historical times; Ambrose[25] makes no mention of these animals. The presence of warthog teeth and some postcranial material in all the sites except Bolahla proves that these animals were present in the region during post-classic Wilton times.

In most of these sites they have been recorded since the Oakhurst period of the Later Stone Age.[8,6]

No authenticated records exist of the recent presence of blue duiker and steenbok in Lesotho.[25] Although Ambrose lists blue buck as having occurred in Lesotho in the past, this is based on a few isolated archaeological finds.[5] The habitat requirements of blue buck are such that their distribution in Lesotho would also mean a different associated flora and fauna, for which there is no trace. One reasonable explanation for their very limited presence in the archaeological deposits is that their remains were introduced by people for purposes unknown. There is a possibility that steenbok occurred there in recent times, but this has not been substantiated. From the various samples it is clear that these small territorial buck were fairly common in the past. Their remains have been identified at all but two of the sites mentioned in this paper.

Ostriches have not been recorded from Lesotho in recent times, but rock art depictions as well as 19th-century missionary records suggest that they were once present in the country.[26] The discovery of an ostrich fibula at Likoaeng supports this observation, suggesting that these birds were hunted in the vicinity of the site.

Combined, the sites discussed here yielded a variety of carnivore species, most of which seem to have been introduced into the deposits by humans. According to the literature, historical San populations in South Africa in areas currently known as the Eastern Cape, Western Cape and Northern Cape provinces hunted or trapped[38] carnivores for various purposes. These included the manufacture of clothing, headgear and other apparel.[38,39–43] The San of the Karoo also made extensive use of carnivore skins for clothing and other purposes.[44] A drilled jackal tooth from the upper levels at Tloutle bears evidence of the use of these animals during the Later Stone Age.[6]

As discussed above, the baboon remains were probably all introduced through human action. Although there is no clear evidence for why they were hunted, they had some uses as attested by the presence of worked teeth. In modern San societies in Botswana there appears to be no record of baboons used as food, at least not in the Dobe area where these animals are occasional visitors.[45]

Larger bovids such as wildebeest and hartebeest have been recorded from all the sites except Bolahla and Likoaeng (Table 3). As the sample of the former is relatively small, this could be an effect of sample size. At Likoaeng, with its much larger sample, it may indicate the specialized nature of the site as a fishing camp, with less emphasis on hunting, except the smaller, more territorial bovids. The only large bovid present at Likoaeng is the eland, but it is not found in the upper layers. Eland remains occur in all the sites, and are particularly common at Likoaeng, but why? The area supported large bovids such as blue wildebeest and hartebeest and these have been identified from most of the shelter sites. Although Likoaeng yielded a few bone fragments of large bovids, these could not be identified to species. At all the Lesotho sites, eland remains are more common than those of any of the other large bovids. It is only at Rose Cottage Cave that blue wildebeest remains exceed those of eland (Table 3). The dominant presence of eland in the Lesotho sites can be explained in terms of species abundance. In Lesotho there is historical evidence that eland were common and widespread but that the blue wildebeest was less common. Although hartebeest have been recorded historically, and appear to have been relatively widespread in the Maluti mountains and the adjacent Drakensberg,[25] there is little information on their numbers. There is evidence that herds of hartebeest and blue wildebeest occurred in the eastern Free State, hence their relatively large numbers at Rose Cottage Cave.

Subsistence strategies

There is a significant increase in the non-fish remains in the lower layers at Likoaeng (Table 1 and Fig. 1), indicating that hunting was the primary activity at first, being supplanted by fishing in later years. In the shelter sites such a clear change of food procuring strategy has not been observed within the post-classic Wilton.

There are only five wild bovid species identified from Likoaeng. Only Bolahla[5] has fewer with two species only. For the rest, Rose Cottage Cave has 10, Liphofung 6, Muela 13, Tloutle 10, Sehonghong 9 and Leqhetsoana 6.[5,11] Although the Likoaeng sample of higher vertebrates is one of the largest, it is not the most varied. This could be a reflection of the more important activities on the site, namely those associated with fishing, in the upper layers. The lack of variety in the lower layers cannot yet be explained satisfactorily. Environmental conditions may have had some influence as Likoaeng lies deep in the highlands. However, some of the other sites where a greater variety is recorded are also located in the highlands. Perhaps activities at open-air sites differed from those in shelters, but as there are no other inland open-air sites with good fauna preservation, comparisons cannot be made.

The variety of species represented at the sites implies that various food procuring strategies were employed. These would have included hunting with bow and arrow for the larger animals, combined with trapping for the smaller, more territorial species such as the small bovids and hares, and collecting for tortoises and molluscs.

Fishing was practised at Rose Cottage and Likoaeng, which will receive attention when the fish samples are analysed.

Sexing, skeletal element representation and bone densities

The shortage in most sites, or, in the case of Likoaeng, the absence of female skeletal elements and the subsequent over-representation of males is misleading. Most males are identified by horncore and pelvis fragments. In the klipspringer, steenbok and grey rhebuck, only the males have horns. Crania do not preserve intact and so it is not possible to demonstrate the presence of females based on the absence of horns. Pelvis fragments also tend to over-represent males because female bovid pelves are more fragile and tend not to preserve as well as those of males. Care must therefore be taken not to construe under-representation of female animals as an aspect of hunting strategy.

Comparison of the skeletal elements preserved and bone density studies[29] show that there is some, but not much, correlation between the two at Likoaeng and some other sites.[20] The results are difficult to interpret, however, as Lyman[29] has shown convincingly that bone densities may vary considerably among taxa. Such studies have not yet been conducted on the bovid species of southern Africa.

In most of the samples, distal and proximal metapodials usually are over-represented. In all the samples, the first phalanges and to some extent the second phalanges are generally well-represented. Third phalanges are often under-represented.[46] These bones are somewhat less robust than the two other phalanges. Their under-representation could be the result of butchering processes. Being covered by hoof sheaths, third phalanges are not easily accessible and may have been discarded with the hoof. The under-representation of sesamoids cannot be attributed to low density. Sesamoids are dense, compact and usually found whole. It may be assumed that these bones were removed during skinning and butchering and were not always part of food waste.[47]

Likoaeng: specialization and aggregation?

The evidence from Likoaeng supports findings elsewhere that there was specialization in food procurement strategies in the interior during post-classic Wilton times. Specialization has also been recorded at later sites in the interior such as Abbot's Cave, where hunters exploited the seasonal migration and lambing of springbok.[48,49] Fishing as an intensified activity seems to have been evident at Rose Cottage Cave,[37] and may be confirmed once the fish remains have been analysed.

Occupation appears to have been seasonal, and the possibility that activities at Likoaeng could have coincided with aggregation periods should be examined. The importance of aggregation/dispersal as a social mechanism associated with environmental conditions has been underlined ethnographically by Lee,[45] Silberbauer[50] and others working with recent Kalahari hunter-gatherers, but is not universal.[51] It has been applied to the Later Stone Age following the lead of Wadley[52,53] (see also Korsman[54]), who outlines several criteria whereby aggregation sites and dispersal locations may be recognized archaeologically, though this has been debated and may not always be straightforward.[55–57] Using Wadley's criteria, there is little sign of Likoaeng having been a focus of aggregation: lithic materials are locally available; ostrich eggshell bead-making was not undertaken and there is little sign of bone point manufacture; potentially shamanistic artefacts are lacking; and any formal organization of male/female areas remains to be investigated. Application of Wadley's criteria requires Likoaeng to be placed within the context of contemporary sites. As Likoaeng is the only extensively excavated site in the Lesotho highlands dating to the post-classic Wilton, this is clearly problematic in terms of lithic and ornamental materials. On the other hand, we *can* approach this question from an archaeozoological angle, and specifically the quantities of fish found (Fig. 1). For example, although necessarily only crudely calculated, the material from Layer V analysed thus far has produced an MNI (minimum number of individuals) figure of 178 for *Labeo capensis*, the species that seems to account for over 90% of the total ichthyofauna. It seems that the number of unidentifiable fish fragments (81 846) is more than 10 times the total number of identified specimens (NISP of 6067) as a conservative estimate. Allowing for the site's past erosion, it is possible that this sample derives from no more than 20% of Likoaeng's original area. If this were true, Layer V alone could have been associated with the capture, processing and consumption of well over a tonne of fish. The quality of the faunal remains (mammalian and fish) and the spatial integrity of the excavated layers makes us think that Layer V, like layers III and VII/IX, represents a quite short-lived occupation (weeks or a few months at most). In turn, this implies that either much of that fish was removed offsite in some form, or that it was consumed by what must necessarily have been a relatively large camp of people. It appears from the preliminary analysis of the fish remains that this occupation was linked to *Labeo capensis* spawning runs, which are short-lived seasonal events. This reinforces the possibility that occupation at Likoaeng may be tied to aggregation around a rich, predictable resource.

It is tempting to assume that the fishing at Likoaeng was largely the domain of men, particularly during the later period. The remains do not prove this, but rock-art depictions of fishing scenes in Lesotho, the eastern Free State and the Drakensberg all show only men associated with this activity.[58–62] This does not necessarily mean that women were absent from the sites, as a reamer and bored stone (Layer V) may indicate the presence of women. According to Ouzman,[63] however, bored stones were at times used also by men.

The clear changes in food procurement strategies during the post-classic Wilton are unique to Likoaeng and have not been observed at other sites. It is clear that greater emphasis on hunting represented in the earlier layers changed suddenly to emphasize fishing in the later layers (Fig. 2). The reason for these changes is not clear. Although the fish remains are still being studied, indications are that the fish species and their relative proportions did not change over time. Furthermore, although eland remains are the most common in the lower layers, they are nearly absent in the younger deposits (Table 2). There are no clear indications why this should be so.

Although Likoaeng has one of the largest of the mammalian samples (Table 3), as a site it is small in the sense that it represented short pulses of occupation only in contrast to the shelter sites, where longer occupations are assumed. With small sites such as Likoaeng, one has to attempt to interpret them in terms of highly resolved spatio-temporal pulses to discover what their occupants might have done. As Parkington (ref. 64, p. 96) writes:

> If we can resolve person, generate an archaeology of interest groups and contemplate the potency of person to person relations as well as society to environment ones, we can write a social history as distinct from a cultural chronology.... To isolate interest groups and resolve person it is important to choose ephemeral sites, dig them spatially and learn to make sense of small samples.... Averaged effects derived from repeated occupations, however statistically seductive, will produce a 'minestrone' effect with little social presentation.

Generally, the Likoaeng layers such as III, V, and VII/IX appear to represent short-lived occupation events, based on their contents and the quality of preservation and integrity that they show.

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1. Mitchell P.J. (1996). The late Quaternary of the Lesotho highlands, southern Africa: preliminary results and future potential of recent research at Sehonghong Shelter. *Quat. Int.* **33**, 35–44.
2. Wadley L. (1995). Review of dated Stone Age sites recently excavated in the eastern Free State, South Africa. *S. Afr. J. Sci.* **91**, 574–579.
3. Hall S.L. (1990). *Hunter-gatherer-fishers of the Fish River Basin: a contribution to the Holocene prehistory of the Eastern Cape.* D.Phil. thesis, University of Stellenbosch.
4. Wadley L. (2000). The Wilton and pre-ceramic post-classic Wilton industries at Rose Cottage Cave and their context in the South African sequence. *S. Afr. Archaeol. Bull.* **55**, 90–106.
5. Plug I. (1997). Late Pleistocene and Holocene hunter-gatherers in the eastern highlands of South Africa and Lesotho: a faunal interpretation. *J. Archaeol. Sci.* **24**, 715–727.
6. Plug I. (1993). The macrofaunal and molluscan remains from Tloutle, a Later Stone Age site in Lesotho. *Sth. Afr. Field Archaeol.* **2**, 44–48.
7. Mitchell P.J. (1993). Archaeological research in Lesotho: a review of 120 years. *Afr. Archaeol. Rev.* **9**(4), 77–132.
8. Plug I. and Badenhorst S. (2001). *The Distribution of Macromammals in Southern Africa over the Past 30 000 Years.* Transvaal Museum Monograph No. 12, Pretoria.
9. Mitchell P.J. (1988). The late Pleistocene early microlithic assemblages of southern Africa. *Wld Archaeol.* **20**, 27–39.
10. Mitchell P.J., Parkington J. and Yates R. (1994). Recent Holocene archaeology in western and southern Lesotho. *S. Afr. Archaeol. Bull.* **49**, 33–52.
11. Plug I. and Engela R. (1992). The macrofaunal remains from recent excavations at Rose Cottage Cave, Orange Free State. *S. Afr. Archaeol. Bull.* **47**, 16–25.
12. Thorp C. (Ed.) (2000). *Hunter-gatherers and Farmers: An Enduring Frontier in the Caledon Valley, South Africa. BAR International Series* 860, Cambridge.
13. Plug I. (2000). Appendix B: The faunal remains from Rooikrans, Ladybrand district, Free State. In *Hunter-gatherers and farmers: An Enduring Frontier in the Caledon Valley, South Africa*, ed. C. Thorp, pp. 81–85. *BAR International Series* 860, Cambridge.
14. Plug I. (2000). Appendix C: The faunal remains from Westbury, Ladybrand district, Free State. In *Hunter-gatherers and Farmers: An Enduring Frontier in the Caledon Valley, South Africa*, ed. C. Thorp, pp. 87–88. *BAR International Series* 860, Cambridge.
15. Mitchell P.J. and Charles R. (1996). Archaeological investigation of an open air hunter-gatherer site in the Lesotho Highlands: preliminary report on the 1995 season at Likoaieng. *Nyame Akuma* **45**, 40–49.
16. Mitchell P.J. and Charles R. (1998). Archaeological fieldwork in the Lesotho Highlands, July and August 1998: the second season of excavation at the Likoaeng open-air site. *Nyame Akuma* **50**, 13–21.
17. Mitchell P.J. and Charles R. (2000). Later Stone Age hunter-gatherer adaptations in the Lesotho Highlands, southern Africa. In *Human Ecodynamics: Proceedings of the Conference of the Association of Environmental Archaeology*, eds G.N. Bailey, L.C. Charles and N. Winder, pp. 90–99. Oxbow Press, Oxford.
18. Talma A.S. and Vogel J.C. (1993). A simplified approach to calibrating ^{14}C dates. *Radiocarbon* **35**(2), 317–322.
19. Brain C.K. (1974). Some suggested procedures in the analysis of bone accumulations from southern African Quaternary sites. *Ann. Tvl. Mus.* **29**, 1–8.
20. Plug I. (1988). *Hunters and herders: an archaeozoological study of some prehistoric communities in the Kruger National Park.* D.Phil. thesis, University of Pretoria.
21. Von den Driesch A. (1976). *A Guide to the Measurement Of Animal Bones from Archaeological Sites.* Peabody Museum Bulletin 1, Peabody Museum, Harvard University, Cambridge, MA.
22. The analyses of the macro-faunal remains from Rose Cottage were completed in 1992, but the fish remains have not yet been analysed.
23. Du Plessis S.F. (1969). *The past and present geographical distribution of Perissodactyla and Artiodactyla in southern Africa.* M.Sc. thesis, University of Pretoria.
24. Smithers R.N. (1983). *Soogdiere van die Suider-Afrikaanse substreek.* University of

Pretoria, Pretoria.
25. Ambrose D. (1999). *Lesotho Annotated Bibliography. Section 168 Mammals.* Institute of Education, National University of Lesotho, Roma.
26. Ambrose D. (1999). *Lesotho Annotated Bibliography. Section 167 Birds.* Institute of Education, National University of Lesotho, Roma.
27. O'Connor T. (2000). *The Archaeology of Animal Bones.* Sutton Publishing, Phoenix Mill.
28. Reitz E. and Wing E. (1999). *Zooarchaeology.* Cambridge University Press, Cambridge.
29. Lyman R.L. (1994). *Vertebrate Taphonomy.* Cambridge University Press, Cambridge.
30. Behrensmeyer A. K. (1978). Taphonomic and ecologic information from bone weathering. *Paleobiology* **4**(2), 150–162.
31. Plug I. (1990). Terrestrial molluscs and archaeological stratigraphy: a cautionary tale. *S. Afr. J. Sci.* **86**, 204–205.
32. Plug I. (1996). Seven centuries of Iron Age traditions at Bosutswe, Botswana. *S. Afr. J. Sci.* **92**, 91–97.
33. Plug observed *Achatina* snails crawling into rock-shelters in the Kruger National Park and at Bushman Rock Shelter.
34. Slide collection of P. Mitchell and J. Hobart, pers. comm.
35. Barnard K.H. (n.d.). *A Beginners's Guide to South African Shells.* Maskew Miller, Cape Town. This publication, although old, provides information on habitat requirements.
36. Appleton C.C. (1996). *Freshwater Molluscs of Southern Africa.* University of Natal Press, Pietermaritzburg.
37. During the analysis of the Rose Cottage fauna in 1991, Plug extracted a large sample of fish remains. These were returned to the excavator for further analysis.
38. Raper P.E. and Boucher M. (eds) (1988). *Robert Jacob Gordon Cape Travels, 1771 to 1786.* Vol. II, 274. Brenthurst Press, Johannesburg.
39. Barrow J. (1801). *An Account of the Travels into the Interior of Southern Africa in the Years 1979 and 1798.* Cadell and Davies, London.
40. Bleek D.F. (1935). Beliefs and customs of the /Xam Bushmen 7: sorcerers. *Bantu Stud.* **9**, 1–47.
41. Bleek D.F. (1936). Beliefs and customs of the /Xam Bushmen 8: more about sorcerers and charms. *Bantu Stud.* **10**, 131–162.
42. Bleek W.H.I. and Lloyd L.C. (1911). *Specimens of Bushman Folklore.* George Allen, London.
43. Orpen J.M. (1974). A glimpse into the mythology of the Maluti Bushmen. *The Cape Monthly Magazine* **49**, 1–13.
44. Plug I. (1993). The macrofaunal remains of the wild animals from Abbot's Cave and lame Sheep Shelter, Seacow Valley, Cape. *Koedoe* **36**, 15–26.
45. Lee R.B. (1985). *The !Kung San: Men, Women and Work in a Foraging Society,* p. 99. Cambridge University Press, Cambridge.
46. Plug I. (1978). *Die Latere Steentydperk van die Boesmanrotsskuiling in Oos-Transvaal.* M.A. thesis, University of Pretoria.
47. Sesamoids are embedded in the tendons at the back of the toes and are usually removed with skinning unless special care is taken to retrieve them. Personal experience and supervising of skinning and defleshing procedures by the first author.
48. Plug I. (1994). Springbok *Antidorcas marsupialis* (Zimmerman 1780) from the past. *Z. Säugetierkunde* **59**, 246–251.
49. Plug I. (1999). The fauna from Later Stone Age and contact sites in the Karoo, South Africa. In *Historia Animalium ex Ossibus,* eds C. Becker, H. Manhart, J. Peters and J. Schibler, pp. 344–353. Verlag Marie Leidorf, Rahden/Westf.
50. Silberbauer G. (1981). *Hunter and Habitat in the Central Kalahari.* Cambridge University Press, Cambridge.
51. Kent S. (1992). The current forager controversy: real versus ideal views in hunter-gatherers. *Man* **27**, 45–70.
52. Wadley L. (1986). *A social and ecological interpretation of the Later Stone Age in the southern Transvaal.* D.Phil. thesis, University of the Witwatersrand, Johannesburg.
53. Wadley L. (1987). *Later Stone Age Hunters and Gatherers of the Southern Transvaal. BAR International Series* 380, Oxford.
54. Korsman S.A. (1990). *A reconstruction of the Later Stone Age on the farm Honingklip in the Eastern Transvaal.* M.A. dissertation, University of Pretoria.
55. Barham L.S. (1992). Let's walk before we run: an appraisal of historical materialist approaches to the Later Stone Age. *S. Afr. Archaeol. Bull.* **47**, 44–51.
56. Wadley L. (1992). Reply to Barham: Aggregation and dispersal phase sites in the Later Stone Age. *S. Afr. Archaeol. Bull.* **47**, 52–55.
57. Jerardino A. (1995). The problem with density values in archaeological analysis: case study from Tortoise Cave, Western Cape, South Africa. *S. Afr. Archaeol. Bull.* **50**, 21–27.
58. Lee D.N. and Woodhouse C. (1970). In *Art on the Rocks of Southern Africa.*, pp. 51–52. Charles Scribner, New York.
59. Pager H. (1972). *Ndedema.* International Scholarly Book Services, Portland, p. 14, 146, 188. This is a special edition for the U.S.A. and Canada, based on the 1971 edition published in Graz, Austria.
60. Willcox A.R. (1963). In *The Rock Art of South Africa,* pp. 26–30. Thomas Nelson, Johannesburg.
61. Willcox A.R. (1984). In *The Drakensberg Bushmen and their Art,* pp. 24–25. Drakensberg Publications, Winterton.
62. Woodhouse H.C. (1979). In *The Bushman Art of Southern Africa,* pp. 84–85. Purnell, Cape Town.
63. Ouzman S. (1997). Between margin and centre. In *Our Gendered Past,* ed. L. Wadley, pp. 71–106. Witwatersrand University Press, Johannesburg.
64. Parkington J.E. (1993). The neglected alternative: historical narrative rather than cultural labelling. *S. Afr. Archaeol. Bull.* **48**, 94–97.

✎ New Books

The following books have been just published or newly issued in paperback.

Biological Sciences

The Migration Atlas. Edited by Chris Wernham, Mike Toms, John Marchant, Jacquie Clark, Gavin Siriwardena and Stephen Baillie. Poyser/British Trust for Ornithology. £55. A compendium of nearly a century of bird ringing in the British Isles.

The Invisible Enemy: A Natural History of Viruses. By Dorothy Crawford. Oxford University Press. £8.99 (pbk).

Coral Reef Fishes: Diversity and Dynamics in a Complex Ecosystem. Edited by Peter Sale. Pp. 724. Academic Press. $99.95.

Ecosystem Dynamics of the Boreal Forest: the Kluane Project. Edited by Charles J. Krebs, Stan Boutin and Rudy Boonstra. Pp. 544. Oxford University Press. $95. The account of a large, decade-long Canadian study conducted in the southwestern Yukon that should serve as a model for similar projects elsewhere.

Proteins and Proteomics: A Laboratory Manual. By Richard J. Simpson. Pp. 926. Cold Spring Harbor Laboratory Press. $250 (hbk); $185 (pbk).

The Adélie Penguin: Bellwether of Climate Change. By David G. Ainley. Pp. 314. Columbia University Press. $59.50.

Darwin and the Barnacle. By Rebecca Scott. Pp. 336. Faber & Faber. £14.99. An account of the eight years Darwin spent before the publication of *On the Origin of Species* and that helped establish his reputation as a force in science.

The Scientific Study of Mummies. By Arthur C. Aufderheide. Pp. 626. Cambridge University Press. £100. Required reading for the serious researcher.

Impossible Extinction: Natural Catastrophes and the Supremacy of the Microbial World. By Charles C. Cockell. Pp. 192. Cambridge University Press. £18.95.

Principles of Animal Locomotion. By R. McNeill Alexander. Pp. 376. Princeton University Press. $49.50. A primary reference work.

Cold Wars: The Fight Against the Common Cold. By David Tyrrell and Michael Fielder. Pp. 268. Oxford University Press. £17.99. The story of Britain's Common Cold Unit, that was closed in 1990 after several decades of valiant endeavour, having generated valuable understanding but no cure for the affliction.

Physical Sciences

The Century of Space Science. Edited by Johan A.M. Bleeker, Johannes Geiss and Martin C.E. Huber. Pp. 1868. Kluwer. $595. A series of 100 essays written by various authorities throughout the century.

Protecting the Ozone Layer: Science and Strategy. By Edward A. Parson. Pp. 396. Oxford University Press. $65.

Protecting the Ozone Layer: The United Nations History. By S.O. Anderson and K.M. Sarma. Pp. 544. Earthscan. $65. This and the previous book illustrate the convoluted route that is followed to translate scientific practice into public policy.

Megawatts + Megatons: The Future of Nuclear Power and Nuclear Weapons. By Richard Garwin and Georges Charpak. University of Chicago Press. $20 (pbk).

Six Degrees: The Science of a Connected Age. By Duncan J. Watts. Pp. 448. W.W. Norton. $27.95. Network dynamics, whether on the Internet or in the spread of disease.

Water from Heaven. By Robert Kandel. Columbia University Press. $27.95. The multifaceted role of water, whether as a component of the atmosphere or the subject of dispute between nations.

Clean Electricity from Photovoltaics. Edited by Mary D. Archer and Robert Hill. Pp. 868. Imperial College Press. £82. A comprehensive reference work on the technologies that have to be taken more seriously.

Undead Science: Science Studies and the Afterlife of Cold Fusion. By Bart Simon. Rutgers University Press. $22. Ever wondered what happened to the claims for cold fusion made in the late 1980s? This book, by a sociologist, will tell you, as well as how an unorthodox idea is received by the scientific establishment.